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CURRENT LITERATURE.

BOOK REVIEWS.

A new treatise on ecology.

THE impetus to a study of ecology as an integral part of botany, coordinate with morphology and physiology, dates back to Warming's *Ecological plant geography*, published only four years ago.¹ The rapidity with which this new field of study is developing is shown by the large number of special treatises which have appeared since Warming's work. This latest work of Schimper² is calculated to lead another great advance, and may be said probably to mark the beginning of a second epoch in the pursuit of ecological investigation.

Schimper, like Warming, is not a narrow specialist, but has made valuable additions to our knowledge in many fields of botanical research. His studies in morphology, cytology, physiology, taxonomy, and ecology have peculiarly fitted him to take up an immense work of this sort in a thoroughly scientific manner. The result of his labors is a volume of nearly 900 pages, a veritable compendium of ecological knowledge, systematized and brought up to date. In the preface the author says that the cue for ecological study was given by the study of plants in extreme conditions, since only there are the effects of environment strongly marked and easily understood. Hence investigations in the tropics, and above all the studies of Haberlandt, Wiesner, and others at Buitenzorg, have given a great impetus to the study of ecology. Schimper appeals for a polar laboratory, so as to study the extreme but relatively simple effects of an arctic environment.

The general divisions of Schimper's *Plant geography* resemble those of Warming. First, the ecological factors are treated; water, heat, light, air, soil, animals. Then there is a discussion of formations and associations in general. Over three fourths of the work is taken up with a detailed description of the formations of the various zones and regions, the tropical, temperate, and arctic zones, the mountains and the waters.

¹ WARMING, EUGEN: *Plantensamfund. Grundtræk af den økologiske Plantegeografi*. Kjöbenhavn. 1895. See BOT. GAZ. 22: 173. 1896.

² SCHIMPER, A. F. W.: *Pflanzengeographie auf physiologischer Grundlage*. Mit 502 als Tafeln oder in den Text gedruckten Abbildungen in Autotypie, 5 Tafeln in Lichtdruck und 4 geographischen Karten. 8vo. pp. xviii + 876. Jena: Gustav Fischer. 1898. Brosch. M 27; geb. M 30.

There are several general features in the work which strike one at a glance, and which are highly commendable. There is a wealth of well-chosen illustrations of plant habits and plant formations, largely reproductions of photographs. These pictures are thoroughly representative, and illustrate the leading features of all regions thus far studied. A second highly commendable feature is the persistent correlation of ecological observations on plants in the field with physiological experiments carried on in the same region. Observation and experiment together check erroneous conclusions derived from one alone. Meteorological data and anatomical study also contribute their part to the interpretation of the facts of observation. In every case, Schimper has brought all possible data together in a more systematic and thorough manner than has been previously attempted. Hence, the probability that his conclusions are correct is very great. The bibliographies are remarkably complete and easy to consult because of their topical arrangement.

Another characteristic that will be pleasing to botanists everywhere is the absence of any undue predilection for Germany and German botanists. The work of botanists all over the world is given a proper share of attention. It is gratifying, too, to see the wealth of material furnished from tropical fields, and largely by the author himself. The use of the word ecology in place of biology is a pleasing departure and a deserved tribute to Warming.

Among the new points of view that are presented is Schimper's statement of the relation between plants and water. Hygrophytes are plants that further their transpiration, xerophytes are plants that check it, while the word tropophyte is introduced to include those plants which are hygrophytic at one season and xerophytic at another. According to this view, these terms are placed on a physiological rather than a physical basis. The plant itself, rather than the soil in which it grows, is called hygrophytic or xerophytic.

Another striking difference from Warming is seen in considering various ecological agents equivalent with water as factors in classification. Thus the simplicity of Warming's classification is replaced by a much greater complexity. This is the common fate of all sciences, as is well illustrated by a comparison of the simple taxonomic system of Linnæus with that of Engler. The great zones of the earth are determined primarily by the distribution of heat, while the great formations of these zones, such as forest, savanna, or desert, are determined chiefly by meteoric water. The local diversities in these great regions are said to be caused by differences in the soil. Thus we have two great types of formations: (1) climatic formations which characterize great regions and are caused by climatic factors, and (2) edaphic (from *ἔδαφος*, soil) formations, which make up the local variations in any district and are due to a local dominance of edaphic over climatic influences. Schimper also lays much greater stress than does Warming upon the

influence of light, heat, atmospheric density, and the chemical nature of the soil, in shaping the character of the vegetation.

It seems unfortunate to the reviewer that more attention was not paid to what may be called, speaking broadly, the geological relation. The short section on the transformation of edaphic to climatic formations is excellent and might well be much enlarged. In order to understand any formation it is necessary to know its history, and this history can be interpreted only by the most painstaking study of areas in which transitions from edaphic to climatic formations are now taking place. With this study there must be coupled a study of the physiographic history of the region. The study of the cumulative influence of past environments, the lagging of effects behind their causes, is still in its infancy. Perhaps it is because of our lack of knowledge along these lines that Schimper's great work deals so much more with static than with developmental ecology.

This new treatise is a distinct addition to our knowledge, both as a compendium of previously stated but scattered facts, and as a source of many new details and better points of view. Of course all ecologists must have it and must be familiar with its contents from cover to cover. This new volume is certain to stand always as one of the great botanical masterpieces. — HENRY C. COWLES.

Economic botany.

ONE of the best works yet written upon cultivated plants has just been published by Dr. R. Sadebeck.³ While the title might suggest that the subject matter would attract only those especially interested in the plants of the German colonies, this is not at all true, since these plants are discussed so comprehensively that their relations to dissimilar as well as similar economic plants of other regions are constantly suggested. After having given a careful description of the taxonomic features of a plant, the author discusses its culture, its native region and its distribution, the varieties produced under cultivation, its useful products and the way in which these are utilized as foods, medicines, or in industrial arts. Photographs and drawings, almost all of which were especially made to illustrate this work, appear in abundance. These illustrations, while having to do almost entirely with taxonomic features, are so excellent that they constitute one of the most pleasing and satisfactory parts of the book.

In the first chapter the author discusses the palms. At least thirteen genera are grown in the African colonies, producing large quantities of food material for local consumption and for commerce. Several of these also supply important textile materials and all are prominent features of the landscape. Another chapter is devoted to the description, cultivation, and

³ SADEBECK, R.: *Die Kulturgewächse der deutschen Kolonien und ihre Erzeugnisse*. 8vo. pp. xiii + 366. *figs.* 127. Jena : Gustav Fischer. 1898, Brosch. *M* 10; geb. *M* 11.